

*Durant (91)* *With kind regards*  
*G.H.P.*

On the Cause, Prevention and Cure  
of Tuberculous Phthisis.

BEING THE

Essay to which the Medical Society of the State of New  
York awarded the Hiram Corliss Prize.

BY GHISLANI DURANT, M. D., PH. D.

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REPRINTED FROM THE TRANSACTIONS OF THE MEDICAL SOCIETY  
OF THE STATE OF NEW YORK, FOR THE YEAR 1871.

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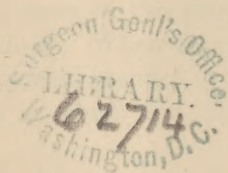
BEING THE

*Presented by  
A. E. M. Purdy*

Essay to which the Medical Society of the State of New  
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# TUBERCULOUS PHTHISIS.

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"Ut potero explicabo, non tamen quasi Pythius Apollo, certa ut sint et fixa quoe dixerō."—CICERO.

"Phthisis means a wasting away, a consuming; but of late years the term has been restricted to that species of wasting disease which consists in the occupation of the lungs by tubercular matter, and the changes which that matter suffers and works."—*Watson's Practice*.

It seemed to me that in calling the attention of the competitors to the *Cause, Prevention and Cure of Pulmonary Phthisis*, the intention was that all discussion should bear mainly upon the most practical points. Besides it will be granted that it would have been difficult if not impossible, to give within the limits of an essay, a complete treatise upon an affection that from the beginning of medical science has exercised the minds of the most prominent men of the profession.

Therefore, neglecting all theories, however satisfactory or unsatisfactory they may be, all anatomical details and mere description of textures, I will endeavor to constantly apply myself to the practical side of the question, and, profiting by the new views, of which clinical observation, supported by history, have shown us the truth, to point out what is the primary cause of this pathological state, and the basis of therapeutical indications. When we know under what conditions and in what manner a morbid product is developed, we are near the discovery of the means by which that development may be averted or prevented.

Tubercle is not confined to one part of the body, but is found in the lungs, brain, kidneys, spleen, prostate gland, epididymis, testicles, uterus, ovaries, serous membranes, etc., and even in the osseous framework of the body itself. Its seat is very variable, though it is most often met with in the cellular tissue, as in the lungs, where it is either in the subserous, submucous, or parenchymatous. It may be deposited upon the surface of membranes or in the midst of other morbid products. It is generally found in the neighborhood of blood vessels, great vascularity seeming an essential condition for its production; the non-vascular tissues, or those which are but slightly vascular, seldom containing it. An important point to know is the relation which exists between tubercle and the surrounding tissue, since it may, under certain conditions, remain latent for long periods of time. More

often, however, it, immediately upon its formation, gives rise to more or less pain and congestion in the neighboring parts :

1st. By the irritation caused by its presence.

2d. By obstructing, in a greater or less degree, the circulation of the blood in the parts in which it has been deposited. And,

3d. By the change which it impresses upon the blood.

If recent observations have settled the important question that tuberculous matter may be deposited in various portions of the body, such as the brain, the lymphatic glands, etc., without a particle being found in the parenchyma of the lungs, we must not lose sight of the fact that the lungs are above all organs, peculiarly liable to this morbid condition, since in them not only does there seem to be an affinity for such a peculiar cell-formation, but the structure, functions, etc., of the lungs, are such as to favor to a far greater extent than any other portion of the body, the formation of this morbid product. They are, therefore, very often the only portion of the organism, in which this growth is found. This is not the only constitutional trouble which tends to localize itself. Variola, syphilis, typhoid fever, etc., all react with far greater intensity upon certain parts of the organism than upon others. Not only do the lungs display a greater impressionability to this disease, but certain parts of them are peculiarly liable to it. Thus it is known that tuberculous matter is more often found at the apex than at the base of the lungs, and that in the former situation its development is most rapid. Louis further observes, and with reason, that the largest cavities are more generally found near the posterior than the anterior border.

Still another important fact for us to consider, is that the left lung is far more liable to be affected than the right. Louis records seven cases in which one lung alone was affected, and of these seven in two cases only was the right diseased, while the left was affected in the remaining five. In twenty-eight cases where almost complete disorganization of the upper lobe on one side existed, this took place in twenty-eight on the left, and in ten on the right side. These facts were known for a long time before any explanation of their cause was attempted. It is only recently that the reason of this phenomenon has been discovered.

During the respiratory movements, the entrance of air into the lungs is determined by the enlargement of the chest. This enlargement is owing in a great measure to the movements of the ribs, sternum and other parts which compose the thoracic parieties. The movable pieces or levers are the ribs and sternum. The vertebral



column which acts as a fulcrum to these levers does not take any active part in producing this enlargement. The ribs which are directed from above downwards, and from behind forwards, in order to produce any amplification of the chest, are elevated anteriorly, the center of motion being at the costo-vertebral articulation. The amount of movements therefore increases directly as the distance from this articulation. This change in the position of the ribs, and sternum of necessity increases the antero-posterior diameter of the chest, that is, the distance from the sternum to the vertebral column. The lateral diameter of the chest is, at the same time, increased by the motion of each rib, around an imaginary axis connecting its anterior and posterior extremities. The sternum also participates in the anterior motion of the ribs, and the amount of movement which takes place is proportional to the distance of the moving part from its superior border. All the movements of the osseous framework of the chest, then are greater, the further we proceed from its superior extremity. From this it results that at its apex the lung is imprisoned in a bony box where little if any expansion can take place, whereas, at the middle, and especially at the lower portion of the lung free expansion can occur.

The anatomical relation and position of the apices of the lungs, and their diminished expansion are the causes of this peculiar tendency of tuberculous matter to develop at the apices rather than at the bases or middle portions of the lungs. The vertebral column is almost immovable, and, as a result, the superior portion of the lung, and especially that part which is posterior, and therefore in the neighborhood of this column, is more often the seat of passive hyperæmia than elsewhere. The presence of the heart upon the left side and its less complete physical development, would in the same way explain the more frequent appearance of tubercle upon that, than upon the right side.

If from the works upon tubercle we attempt to gain any knowledge of its nature, we find only the most conflicting statements. The hundreds of theories concerning its origin are all very ingenious, but all are easily refuted. Fourcroy and Baumes for example, state that the cause of tubercle is too great a supply of oxygen, while others such as Cooper and Richerand, make it depend upon debility and atony of the system. Andral thought he had solved the vexed problem, when he announced that tubercle was formed from pus, which being deposited at some point of the organism, acquired a greater degree of hardness, and finally presented the aspect of

tubercle. Cruveilhier and Lallemand's experiments, to show that tubercle is only concrete pus, are not more conclusive than the theory of Andral, since the microscope shows radical difference between the appearance of concrete pus globules and tubercular matter. Broussais was of the opinion that tubercle had its origin in a diseased condition of the white circulatory vessels. This view however must be abandoned since, as Papavoine has shown, the lymphatic vessels of a tuberculous ganglion may be injected just as readily as if they were in a perfectly healthy condition.

Dalmazzone is of the opinion that the milliary tubercle described by Laennec is only a development, or the second stage of tubercle; the first being a small round cellular body, of a red or yellowish tint, and about the size of a millet seed, which is attached by more or less vascular filaments to the surrounding tissue. Barron believed that the small red points which first appear in the tissue, and later on become studded with gelatiniform granulations, are only blood cells which have escaped through the walls of the extreme capillaries, and which become transformed into tuberculous matter. Bouchat also regards them as originating in the blood. He concludes that they are the result of hyperæmia, and, following that, the obliteration of some of the capillary vessels; that they are not bodies which depend upon a special circulation for their development and growth, but like certain parenchymatous vegetable products, they have their periods of development, maturity and softening, the latter being their death. Finally, Boyer, after vainly endeavoring, from an examination of all these theories concerning the cause and nature of tubercle, to obtain some information concerning the nature of the affection itself, tells us that tubercle is an accidental product, resulting from the exudation from the capillaries of a plasma, very rich in gelatiniform molecules, which are found to absorb salt, especially calcium phosphates. This exudation grows by epigenesis, and it rather pushes out of the way than destroys the tissue in the midst of which it is developed.

Bayle, Laennec and Vogel consider tubercle as well as cancer to be new elements in the organism. Lebert looks upon it as specific in its origin, and possessing perfectly definite and fixed characteristics.

As we see, the opinions concerning the nature of tubercle are manifold, and the question we are called upon to decide seems to be, whether tubercle is a product secreted in the body just as certain foreign substances are, or whether it is an accidental organized body, possessing a life peculiar to itself.

We believe that in the present state of medical science it is no



longer possible to admit that in either health or disease, any new element of another kind or nature, parasite alone excepted, other than those which are normal in character, can be produced. The knowledge of the different phases through which all normal elements of the body pass, from their germination to their final destruction, which has been gained by means of the microscope, has overthrown the doctrine of epigenesis, as well as that of the specific nature of morbid products. All pathological products are homologous, not heterogeneous, and whatever characteristic appearances an abnormal product may have, which point it out as differing from the physiological or normal tissues, are only the result of a dystropic state more or less advanced. Tubercle is neither a parasite nor a heterogeneous product, it is *an altered homologous element*. Virchow truly described it when he called it a poor product, a miserable neoplasm from the start, for in truth, there exists neither life, organization nor trace of circulation in it. From the beginning tubercle *is the result of a weakened and vitiated nutrition*.

It remains now for us to consider what elements of the body are capable of undergoing transformation into tubercle. According to Perroud these elements are the white globules or leucocytes, epithelial cells, fibro-plastic elements, medullary cells and blastema. The same author, in studying the process of tuberculization, how it is that certain elements are transformed into tubercle, taking into consideration the most recent developments, both microscopical and chemical, has arrived at the conclusion that the first step toward this change is the death of the normal tissue, and following this, decomposition of the effete material. Nature now attempts the removal of these products; the fatty portions are in a measure separated from the protein elements; alkaline fluids are poured out to form a soap with the fatty materials, in the same manner as the dead fetus *in utero* is removed, and as fat is formed in the cadaver. Certain portions are thus rendered capable of absorption, and there remain dessicated mummy-like elements, to which are added, later on, pigment granules and calcareous salts.

Unfortunately, however, this reparative process but seldom occurs. The neighboring tissues, irritated by the presence of tuberculous masses, pour out their secretions abundantly, and the tubercles instead of drying, swell up, and increasing greatly in size, assume the appearance of pyoid globules. This is what is called the softening of tubercle. When the disorganization has reached a more advanced stage only granulations, the remains of the tuberculous histological element, are seen.

From the anatomical conditions which tend to the production of tubercle, and from the considerations which we have added as to its mode of formation and evolution, there results:

1st. That tubercle is not a new or specific element.

2d. That many of the normal tissues are capable of being transformed into tubercle. And,

3d. That in order for this change to take place, it is necessary that death of the tissue, followed by decomposition, partial dessication, mummification, and finally softening due to the absorption of these pathological products, should take place.

The conditions, then, which give rise to the production of tubercle, are manifold, and the result of the development of the morbid product is dependant entirely upon the condition upon which it was founded; the gravity and intensity resulting entirely from causes extrinsic to tubercle itself.

Since tubercle, in the same manner as gangrene, results from the disorganization and decay of normal tissues, it may be dependant upon a local or a general cause. In order to determine to which of these two causes it owes its origin, since the effect produced upon the organism will not vary in the slightest degree, clinical observation must be resorted to, as it alone will enable us to recognize the characteristic differences by means of which these varieties of tuberculosis may be distinguished.

Of the conditions favoring a development of local tuberculosis, the only species with which we are at present concerned, there are two which often co-exist:

1st. The retention of histological elements, which, having performed their function in the economy, have become effete, and therefore should have been eliminated from the system.

2d. Perversity, or diminution of formative power of the neighboring tissues.

The aggregation of an infinite number of anatomical elements constitute the organism. Though each in itself is perfectly distinct and separate from all others, and though each is developed according to, and is governed by its own laws, yet all organic elements are subject to the general physical laws which control all bodies.

The different modifications which the anatomical elements are susceptible of undergoing, will not differ in the least if these changes be, on the one hand, produced by natural physiological causes, or, on the other, by some morbid agent. The difference is in degree only, not



in kind, for both owe their existence to one and the same cause, viz.: the properties themselves of the living matter.

The presence of some external cause is a necessary requisite for the induction of changes in organic elements. In the complex living organism, however, one cell may react upon another as a foreign element, and thus the cause may reside within the body itself. This influence is the more worthy of notice on account of the affinity which seems to exist between different substances and organs, thus localizing certain physiological and morbid actions. Since substances which are carried through every portion of an organism by its circulating fluid must exert a greater or less influence upon every part of it, are we not justified in ascribing their limited action, their natural selection for certain tissues, to the influence exerted by peculiar conditions of the cells of which the body is composed? In the one case the cell is enabled by its inherent power to resist all action which can be perceived by the senses, while in the other, where the external influence is greater than the resisting power of the cell, changes take place; these modifications, in every case, being dependent, not only on the character of the external force, but also upon the character of the cell itself.

As there exists no effect without a cause, so there is no reaction which is not dependent upon an action having its cause external to the molecule undergoing change. If, then, there be no physiological spontaneous disturbance in the living organism, still less can there be any pathological one. If a nerve cell generate excito-motor force, and thus give rise to convulsive muscular twitchings, or if pus or tuberculous matter be developed from a plasmatic cell, it is because some external influence has operated upon the nervous or plasmatic cell and thus produced the effect observed. (*Villemin.*)

We may here anticipate and say that the granulations which are seen so thickly sown throughout the lungs, the pleura, the peritoneum, etc., are due to the direct influence of an external agent, which must have been present wherever these granulations are found.

Broussais and his school mistook the effect for its cause, when they described pathology as an "irritation and inflammation." With Liebig, we would define pathological changes as "an intimate abnormal molecular modification, anterior to all symptoms, producing those which are manifested, and among which stand foremost, irritation and inflammation."

If this molecular modification, morbid in character, the result of conditions or relations which previously did not exist in the body,



determined by one or more modifying agents, whatever they may be, permits the circulating fluid to pass as freely as in health then, although, in passing through tissues which are the seat of, and modified by morbid influences, it must leave these tissues in a form more or less altered, "irritation" only exists. This "irritation" then, may be defined as a change in the conditions or relations existing between the component elements of an organism in its normal state, and an alteration in the physiological actions and re-actions, peculiar to the component molecules. If, however, the cause is intense enough to interfere with the circulation of the fluids, or to destroy any portion of the living aggregate, then there results a stasis of the fluids and congestion of the parts, followed by tumefaction. By this alteration new affinities are created, actions and re-actions, generally abnormal in character, result, and heat is developed. The molecules of the organism subjected to conditions unsuited to their existence die, and in their metamorphosis give rise to new molecular combinations, exudations and the formation of pus resulting, the change being accompanied by more or less pain, constituting suppuration. Thus we have seen how the general characteristics of inflammation, congestion, swelling, heat, pain and suppuration, are produced.

When science attempted the investigation of the phenomena of inflammation, the constant presence of an increased vascularity seemed to demonstrate to pathological anatomists that hyperæmia was the *sine qua non* of inflammation. It was also noticed that effusions of purulent or organizable material into cavities followed closely this hyperæmia. This led to the discovery that from the dilated vessels fluids transuded, which were either developed into tissue or underwent a retrograde metamorphosis, and that the presence of these products of abnormal cell action was the evidence of inflammation. Now, as a difference had to be made between phlegmasiac exudation and physiological congestion, the former was made dependent upon the latter; exudation became, therefore, a mere passive act, and its character could depend only upon the fluid furnishing the exudation matter. This view supposed, then, the presence of cancer, tubercle, pus, etc., together with plastic material and the constituents of normal tissue, are already formed in the blood, and ready at any moment to be filtered out from the circulating fluid, to become fixed in the organic tissues, or spread out on its membranes.

Viewed, however, in the light of modern science, the blood has lost almost entirely the pre-eminence which it before held in a pathological point of view. We can no longer look upon it as a fluid

possessing that independent existence which, even to-day, some physiologists are disposed to grant it. We must regard it as a product composed of parts of intrinsic and extrinsic origin, certain morphological elements of which are furnished by the various organs of the body. None of its elements are capable of perpetuating themselves. All require renewal, and renewal generally by means of the digestive apparatus. Thus, water, sugar, albumen, fat, salt, etc., are furnished directly; fibrin is but a modified albumen, and urea, creatine and creatinine are products of disassimilation. The blood cells have their origin in the glandular apparatus. We look, then, upon the blood as being dependent to the same extent upon the tissues that they are upon that fluid; and we must seek the cause of any alteration in the character of the blood, in the tissues through which it flows, and the changes undergone by the organs whose duty it is to furnish the necessary elements of which it is composed. For, not only does the blood carry to all the organs the elements necessary for their nutrition, but it also bears away all those products which have become worn out and therefore foreign material.

The dilatation of the blood vessels, the hyperæmia, the sanguineous stasis, the exudation, all remain as present and incontestable phenomena in the course of an inflammatory process; but they are no longer regarded as causes; they are merely the effect of changes in the force, constancy, activity, and number of the organic elements. The increased activity of these elements is at first manifested by an augmented volume, diminished transparency, and changed aspect. It may stop at this point, and the elements return to their normal shape and size, thus constituting retrocession; or, secondly, this increased activity may be followed by a more or less complete destruction of their organic properties. The change impressed upon the elements, from whatever morbid cause resulting, seems only to end with their death. There is a physiological loss, not only in the amount, but in the kind of material, since many of the cells, though not entirely destroyed, undergo a retrograde metamorphosis, a fatty degeneration. Lastly, we may have after the tumefaction, and opacity of the cells, an increase in their number. Hyperplasy, or hypertrophy of cells, in regard to number, must not be regarded as confined to inflammations; it is common to all neoplasia. At the beginning of hyperplasy, no difference is perceptible to our senses in the manner of development of the cells of cancer, tubercle, or those which are to become normal tissue.

In all formative processes two things must be considered, the cells and the connective tissue. The latter is determined by and under the

control of the former. If the newly formed cells have developed around them connective tissue, so as to fix them in place, new tissue, more or less durable in character, results; but if this retaining element be not developed, then the cells become morbid products, and are bathed by a more or less sero-albuminous fluid. If this new formation takes place upon the surface of a membrane, then the determination tends to the surface; but if in an organ, then the morbid products tends to a *fomes morbi*. This is what is known as suppurative inflammation. When this morbid condition is reached, the cells multiply very rapidly, and with a certain degree of uniformity throughout the part attacked, so that in a very short time the entire portion degenerates into a mass of pus globules, which is almost entirely separated from the surrounding parts. (*Villemin*.)

We may go still further, and say that the amount of pus formed, or, in the morbid condition to which we intend more particularly to devote our attention, the amount of tubercular matter depends upon the quantity of blastema which has been changed in regard to its normal composition or determined from its proper place. If, by any means this material, now morbid, can be evacuated, and the condition of the proliferating cells so changed that they shall no longer produce this diseased element, then we can arrest the progress of this disease, and, provided the cause which produced this morbid condition no longer exists, hope for a restoration of the parts to their normal condition. If, on the other hand, this morbid product be not eliminated, then by catalytic influence it determines a still further production of tuberculous matter, and this alteration of normal tissue continues and increases locally, until, finally, the cells of the blood becoming influenced by the ferment, are themselves, when a suitable nidus is found, capable of inducing the tubercular change. The same result will also follow if the matter be eliminated, but the cells already formed be allowed to continue in full vigor.

In all morbid states of the system, there is always a greater or less degree of inflammation present, though very often it is of so slight or transient a character that it is not perceptible to our senses. It may be entirely local, or may pervade the entire organism. In all diseases, in pulmonary phthisis, consequently, we will find, in certain parts of the organism where the morbid modification is carried too far, a material lesion sufficient to disturb or even to arrest the normal functions of these parts, and, owing to this interference, the fluids of these portions of the body accumulate. This is congestion, the first phase of inflammation. The above may be readily demonstrated by placing



under the microscope a portion of the mesentery or of the foot of a living frog, and then applying some strongly irritating substance to it. Immediate change in the state of the circulation, followed by an accumulation of blood about the point which has been irritated, shows that the normal conditions of existence have been changed. This point is said to be irritated, or, according to our view, modified with respect to its intimate conditions of organization and function, by the body which we have employed. We must not, however, think that the sanguineous molecules which accumulate are always drawn to that part. A few modifying agents may, it is true, act by attraction or affinity upon the sanguineous molecules, or the others which may be there. They may perhaps fix them there, and thus create a local impediment, and become a cause of the accumulation of the fluid and congestion of the part; other agents, however, may act in an entirely different manner, and far more intensely. A contondant body, for example, may change, or even destroy the organic aggregate without attraction, create thus an obstacle to the capillary or endosmotic circulation of the liquids, and necessitate thus, their accumulation, congestion, and following this, all the other symptoms of inflammation. Once accumulated, the sanguineous, or other globules may attract or repulse one another mutually, and offer to the eye a repetition of what takes place in the solution of a substance, which may or may not crystallize. Sometimes there is attraction, sometimes repulsion, but always modification.

Inflammation then may be understood to be an intensified physiological action of the fundamental tissues. Although in many morbid conditions, tubercle and cancer for example, it is said to be absent; yet the ultimate phenomena differ so very slightly, if they differ at all, that we must regard it as being common to these, as well *as to other diseases*.

As regards the action upon which the deposit of tubercle depends, a moment's consideration, will show us that the whole discussion turns upon the word inflammation. "If by that term," says Bennett, "be understood pain, heat, redness, etc., then tubercle is not inflammatory. If, on the other hand, we consider that the essential phenomenon of inflammation is an excreased exudation of blood-plasma, then tubercle must be regarded as an inflammatory product. What then constitutes the difference between the products of ordinary inflammation and tubercle? It is the comparatively unorganizable power of the latter. In tubercle we have granules and imperfect cells; in the product of healthy inflammation, we have granules and perfect cells. Both these

morbid products are formed by the exudation of the blood-plasma. If it undergoes transformation into perfect organisms, it constitutes what pathologists, have, in some cases, called the result of inflammation, in others different kinds of tumors. If the transformation be arrested or rendered imperfect, it forms what has been called tuberculous or scrofulous deposits."

Whatever tubercle may be, it does not differ in the least as regards its formation from pus. Both originate in an increased proliferation of cells; but while the cells of the former are held closely, bound down by the connective tissue surrounding them, the later are free and float in an albuminous fluid.

Whatever formative processes take place in the organism, whether they are physiological or pathological, necessarily give rise to an increased nutrition, in order to supply material, out of which the new growths are to be found. Thus all inflammatory processes are accompanied by a greater or less afflux of blood to the part involved. This is but a phenomenon consecutive upon, and subordinate to the activity of the cellular elements. It is true that a congested condition of any part of the system may develop a similar reaction throughout the economy, since many irritants produce this result. As the supply of blood is regulated by the innervation of the part, the prolonged stimulus of an over supply, may give rise to the same result namely, the formation of new tissue. This, however, does not in the least invalidate, in fact it confirms the proposition, we may say the truth, that all the phenomena of inflammation and neoplasia have their origin in cell action, and that this alone, the original cause which impressed the change upon the cells being removed, has the power of originating and carrying on these changes.

On account of this congested state of the elements of the organism, alimentation takes place far more readily and to a much greater extent than in the normal condition; and, sooner or later, certain principles of the blood are absorbed or modified, thus changing the condition of that fluid. It was formerly considered, that all products physiological as well as pathological, had their origin in a fibrinous exudation, which suffered spontaneous organization in various ways, according to the conditions under which the exudation took place, and the character of the organ or tissue in which it took place. Thus, bone being formed in one locality, pus in a second, cancer, tubercle, etc., in a third, etc. To-day, however, we regard this augmentation of fibrine as an effect not as a cause of phlegmasia; for we find that at the outset of all inflammatory processes, the amount of fibrine is but

slightly increased, while it reaches its maximum at the stage of supuration. The presence of fibrine outside of the circulatory system, is due to one of these causes:

1st. Rupture of the vascular system.

2d. It is a product of cell action, being formed from the albumen of the blood in the place where it is found.

3d. Fibrine is not the plastic blastema it was formerly supposed to be; it is rather a product of disassimilation, since in all probability it results from the oxydation of protein compounds.

This view of the case is rendered still more probable by the fact that the lymphatic fluid, which is a residue of nutrition, contains fibrine in almost exactly the same proportion as the circulatory fluid; while the amount of albumen in the latter, is far less than in the former; thus showing that the fibrine is a secondary product, and developed at the expense of the albumen, contained in the nutritive liquid. Add albumen to lymph and we have plasma.

According to Milne Edwards, the fibrine of the lymphatic plasma, seems to have its birth in the connective tissue. In fact when at any point whatever of the organism, the state called inflammatory is manifested, we very soon see the intermediate tissue, and the cavities enclosed by it gorged with a coagulable liquid rich in fibrine. Did this fibrine arise from the blood by exudation, the amount so lost should diminish the quantity contained in the circulatory fluids; but the contrary of this proposition is found to be the case; the amount of fibrine in the blood increases, instead of diminishing and, therefore, cannot be obtained by direct exudation. Fibrine seems to be constituted, *in situ*, in the diseased tissue, and what takes place in that pathological state, seems to be only the exaggeration of one of the effects which the nutritive work—which is the normal condition—produces in the same parts. A portion of fibrine originating in the immediate neighborhood of the sanguineous capillaries, or even at the external surface of these vessels, the walls of which are devoid of epithelium, must necessarily be conducted away by the venous blood, but the greater portion is likely to mingle with the lymph, and aid in the formation of the plastic part of that fluid, which replaces the fibrine destroyed in the blood.

If in the animal world we find the various elements of which an organism is composed, the osseous, the cartilaginous, the nervous, the muscular, etc., to which must be added morbid admixtures, such as the syphilitic, the tuberculous, the cancerous, etc., circulating in a confused mass through the nutritive fluid, would we not in the vege-



table world expect to find the same rule hold good, and in the juices of the plant find a blastema, taken already formed from the soil suited to the formation of each part, leaf, flower, fruit, bark, etc? In the soil no blastema whatever is found, only the ultimate elements of which the parts are to be built up. These are absorbed and transformed by the plant. The same thing is true in regard to the animal organism, the ultimate constituents being furnished it in the ingesta, and these by cell actions are combined so as to form the necessary tissues. (*Villemain.*)

Tissues are formed or repaired from a living fluid capable of furnishing elements which, in their turn, may be transformed into the parts required. This fluid is the organizable lymph of the classic writers, and the blastema of micrographers. In order that blastema may be developed into tissue, it must possess a greater or less degree of vitality, or power of organizing. This it may obtain from two sources: 1st, from the general constitution of the individual, any vitiation of which will develop pathological lesions; and, 2d, the blastema is also developed at the expense of the surrounding tissues, and any morbid state in them is reproduced in the newly-formed tissue. They impress upon the cell its characteristic properties, thus giving rise to muscular, nervous, osseous, etc., etc., tissue. This power has been called, by the Germans, the law of analogy of formation. Chemists call it catalysis: some modern physiologists have given it the name *catabiosis*. It is what Geoffroy St. Hilaire denominates *la loi d'affinité de soi pour soi*.

If the preceding observations be correct, is it not evident that, in any tissue the vitality of which is impaired, histological elements can only develop partially, or if, by chance, they do develop, have impressed upon them the same changed or morbid condition which is affecting the tissue itself. This is what takes place in inflammatory states. The histological elements of which the tissues are to be formed die almost in an embryonic state, and are unable to fix themselves in place with cellular substance; they swim in a sero-albuminous fluid, constituting pus, or, the fluid being absorbed, develop into tubercle, cancer, or some other abnormal cell formation.

Phthisis, then, is an inflammatory condition of low intensity and chronic character, with pathological formation. The retention of this secretion is indispensable to the formation of tubercle.

Until quite recently, the doctrine of the hereditary nature of tubercle was almost universally believed. However, when we study the complex phenomena, and examine carefully the contradictory opinions which have been expressed concerning this influence, we gradually lose faith

in its correctness, and finally doubt its influence altogether. Even if we were to admit the truth of the dogma of hereditary transmission, statistics would contradict us; for, of 374 cases occurring in old women at the Salpêtrière hospital, reported by Piorry, 78 died without presenting any trace of tubercle, although their parents died from that disease. So Mr. Scott Allison, physician to the Brompton hospital, an establishment entirely devoted to the treatment of pulmonary phthisis, states that, out of 603 cases, he has only seen the influence manifested in nineteen cases. We cannot look upon pulmonary phthisis as hereditary; and we are supported in this view by the observation of M. Pidoux, that "there is not more than twenty-five per cent of those born of phthisical parents who themselves become phthisical;" and further observation only leads us to doubt, and even to deny, any hereditary nature in that disease. It is rather an individual circumstance, indicating that the blood and organic disposition of the individual are such that, at a certain time, and under the influence of certain causes, this disease may develop in him more readily than in another person. It is rather a diathesis, an idiosyncrasy, than a cause. Broca tells us that "diathesis is not a disease; it is only a cause of disease; it is even only a presumed cause; for it does not come under the cognizance of the senses; it is a theory of the mind, and not a thing observed or observable; it is deduced from reasoning."

The tuberculous diathesis has often been compared with the syphilitic, and is now considered by many authorities to be its grandchild; but the two are entirely different, not only in the manner in which they manifest themselves, but also in their origin. The syphilitic diathesis, up to a certain point, is entirely foreign to the organism. It has its origin in a specific principle exterior to it, which, at a given time, is introduced into the body. The progress from a local to a general affection is due to the general diffusion of the virus throughout the body, and to the reproduction of its peculiar cells; while, in the former, it is merely an aptitude which is ordinarily inherent in the organism, and which, under the influence of the most diverse causes, gives origin to the morbid manifestations. One has a single, special specific cause; the other is the effect or influence of condition. It is not tuberculosis that causes the offspring to inherit pulmonary phthisis. It is the influence which that malady exerts upon the constitution of the parent, to weaken it, and, through the parent, the constitution of the child. It is this weakness, this want of power to resist disease, and not the direct transmission of the tubercle itself, that so often aids in its development in the offspring of tuberculous parents. Very often

this weakness of the offspring is due to other disease; and in these vitiated constitutions, from whatever cause arising, we always find a less power of resisting the encroachment of disease. (*Viemeyer.*)

All practitioners have observed the fact that individuals are often found, who, notwithstanding they are the offspring of parents in whom tuberculosis was well marked, throughout a long life never exhibited any symptoms of the disease; and, on the other hand, individual members of a family, without suffering any undue hardship or exposure, and without any appreciable cause, have become the victims of this malady.

In truth, it seems as if each being had his own individuality in regard to health and disease. He may inherit dispositions from one or both parents, or from remote ancestors, or he may be so original as to differ entirely from his parents, and possess an entirely new predisposition; thus he may inherit disease, or he may develop it *de novo*.

"To-day we can affirm, without fear of denial," says Deray, "that it is to hereditary transmission that is due, in a great measure, the fatal propagation of this disease—tuberculosis; but, far from admitting, with certain authors, that parents transmit to their children an organic predisposition, which must, at a certain time of life, necessarily give rise to the development of tubercles, we think that phthisis is hereditary only in so far that the tuberculous parent may transmit to his offspring an organization which is more prone to be influenced by the causes which give rise to tubercle than another." We believe that this view is the only logical one, and that the theory of direct transmission is not only in opposition to reason, but to the results of clinical observation.

What are we to understand by hereditary transmission? Do the offspring of persons suffering from phthisis inherit the disease itself, or do they have impressed upon the organism a predisposition to be influenced by all causes which would produce the disease? If disease can be transmitted directly, it is necessary that the germ of the disease be transmitted at the same time as the germ of life itself. This germ must be the agent producing the disease, if phthisis is transmitted as syphilis is; for the child born of syphilitic parents is impregnated with the virus from the beginning; he is born syphilitic, and does not become so from the action of extraneous causes. He has within himself the cause of the disease. This is not the case in tuberculosis. Very often a man born of phthisical parents enjoys robust health for years, and is then suddenly attacked by tuberculosis. The child of syphilitic parents is syphilitic at his birth; the child of phthisi-



cal parents may develop tuberculosis at five, ten or fifteen years later. And we may well ask, with Villemin, how will the upholders of the theory of hereditary transmission explain why the disease should remain latent so long?

Guizot in 400 post-mortem examinations of the bodies of new born infants, failed to find a single deposit of tubercle. Gluze asserts that there is no born tubercle.

If, then, tuberculosis cannot be directly transmitted, what meaning are we to attach to the term tubercular diathesis? Is it a disposition which certain organisms have to receive tuberculous deposits, and to furnish them with a soil capable of nourishing them, or is it the power of developing tubercle independently of all germs?

We have already seen that the latter view is opposed to both reason and clinical observation. The former theory that by hereditary transmission we are to understand an aptitude or impressive ability to contract it, is the only tenable one. That such susceptibility exists, is proved by the instances in which the children of parents, in whom the disease exists, perish one after another from the disease. Yes, for us, the hereditary transmission of morbid aptitudes, the organic sensibility of Bichat, seems to be a well established fact, a general law governing the organism. Doubtless constitution is transmissible. The child generally inherits from its parents some of their characteristics: strength will engender strength, feebleness generates feebleness. A father whose nervous system is very highly developed, will find the same thing reproduced in his offspring, while another parent whose sanguineous system is strongly marked, bequeaths it to his children. This transmission of individual peculiarities is perhaps more strongly illustrated by the system of vegetative life. This, the basis and foundation of the organism, is generally inherited with all its qualities and defects.

In the same manner, then, as healthy and morbid predispositions of the body vary according to the individual, so does the susceptibility to phthisis. The aptitude for contracting this disease is similar to that for any other. The degree of aptitude for the development of disease, reveals itself in this, as in other morbid states, and nothing more. We see constitutions susceptible to various diseases, pneumonia, variola, etc., and we find the impressionability transmitted to the offspring in a manner just as marked as we do in tuberculosis, and yet who will say that the disease *per se* was inherited?

The arguments given above lead us to conclude, that the syphilitic diathesis is entirely distinct from the tubercular; that while the

former contains the disease in itself, the latter however strong it may be, cannot produce the disease. It requires the intervention of an absolutely essential and indispensable element, a determining agent to produce this disease. Tuberculous diathesis may render the effect more easily attainable, but it *cannot produce tubercle*.

The most competent clinical and histological writers of to-day, agree in seeking the ultimate cause of tubercle in a perverse or imperfect nutrition.

“Daily experience,” says Niemayer, “teaches us that a bad state of nutrition is usually accompanied by a feeble endurance of noxious influences. Even without special knowledge of the fact, it is usually assumed *a priori*, that feeble, badly fed persons are sickly; that they are especially prone to disease and do not recover as speedily from its attacks.”

Thus while pathological anatomy, strengthened by histological researches, teaches us, on the one hand, that tubercle is but a normal element, altered, decomposed, and mummified, clinical observation points it out as a result of vitiated nutrition.

Some of the later writers upon tubercle, Bennett, Bouchardat, etc., have not only ascribed a defective nutrition as its cause, but have even gone further and attempted to determine the precise change in the digestive functions. Thus Bennett declares, that a want of power to properly digest and assimilate albumenoid substances and fats, is the cause of tuberculous deposit.

Among the other causes assigned for this morbid element, we should mention, as exercising a great influence, cold, dampness, sudden changes of temperature, contrast of season, want of air and light, venereal excess, intemperance, in short anything which tends to decrease the physical strength. In the same manner the lymphatic and serofulous constitutions, and the hereditary syphilitic diathesis, especially when local inflammations, by becoming chronic, keep up a state of nutrition which is different from that necessary for the production of normal molecular matter, become powerful predisposing agents to the formation of this neoplasm.

All local inflammations or congestions, such as bronchitis, pneumonia, pleurisy, etc., even though they affect the respiratory apparatus but for a very short space of time, are, in persons who are at all predisposed to tubercle, grave affections, which cannot be checked or palliated too soon. The softening of tubercle already deposited, or the deposit of tubercular matter, is very often the consequence of such an inflammation. Indeed, anything which tends to promote congestion

or inflammation of the respiratory organs, such as the sudden cooling of the periphery, especially of the feet, the suppression of the catamenia, the sudden disappearance of hemorrhoids, the cure of any disease which had previously produced a flux from an organ, may prove a cause of tubercle.

Among the causes which have been given as producing phthisis is a too prolonged nursing. According to the observations of Natalis Guillot, each time the child is nursed from eighty to 200 grammes of milk are abstracted, so that in the course of a day from 1,000 to 1,500 grammes are removed. Now, according to the analysis of Regnault, 10,000 parts of milk contain 3,697 parts of mineral salt, of which 2,232, or two-thirds, are phosphates. The infant removes daily from the system of its nurse three and a half grammes of phosphates, or more than a kilogramme in the year.

A too abundant catamenial flow exhausts women, impoverishes their blood, and determines an anæmic condition, with all its evil consequences. The blood is pale, serous, and colors the linen red, with a yellow areola. This species of metrorrhagia is a sign of a weak constitution, and is often followed by tuberculosis. Here we find the primary cause, viz., chlorosis, aggravated at each menstrual period, and daily tending to further impoverish the blood.

Another cause, and, according to MacCormac, the only true cause of tubercle, is prebreathed air; for, sooner or later, the uneliminated, because unoxylized, carbonaceous waste will be deposited as tubercle. Without acknowledging that prebreathed air is the only agent capable of producing tubercle, we fully recognize the application of the aphorism of Ramazzini, "such air, such blood." Those pursuing sedentary occupations are far more liable to phthisis than those whose labor requires them to spend much of their time in the open air.

Coste has demonstrated that phthisis may be produced in dogs and other animals at will, by keeping them in cold, damp places, and carefully excluding the light.

We can readily understand how a chronic enlargement of the tonsils, by interfering with the normal respiration, can lead to consumption. Only a portion of the requisite amount of air can be respired, and the development of the chest is thus interfered with. Indeed, we may even say that the capacity of the chest diminishes as the tonsils enlarge. Dupuytren was the first to notice that children whose tonsils were enlarged ended by having a deformed chest. In them the thorax was rounded behind, retracted in front, and flattened at the sides. Reduction of the tonsils relieves the aerial tract from the bar-



rier, and permits the lung, and consequently the chest, to regain its regular dimensions.

It is an established fact "says Davis, though one not well known, that all things being equal, an animal digests and assimilates food just in proportion to the quantity of air he respire. If this proposition be admitted, it then follows that if we have diminished respiration we must have diminished assimilation, consequently a condition of the vital powers favorable to the development of tubercle. Again, if a depressed state of the powers of life favors the formation of tubercle, it follows that an exalted state of vitality becomes a serious obstacle to this development, and if they are present, it not only prevents their degeneration, but actually necessitates their absorption."

There is another point which has neither received the attention which it deserves, nor been granted the importance due to it. It is the facility and rapidity of absorption of normal or morbid elements, contained in the air, by the pulmonary apparatus. The experiments of Cl. Bernard, upon the rapidity of absorption, and general distribution throughout the circulatory torrent of toxicological and other substances, which are either injected directly into the veins, or absorbed by the respiratory apparatus, demonstrate the truth of this proposition beyond the probability of refutation.

Of the importance of the lungs, as eliminators of noxious substances, we can judge from the fact, that hydrogen sulphide injected into the jugular vein, was found in the expired air in from three to four seconds.

A further proof of the rapidity and completeness of absorption of foreign substances by the lung, was given by Dr. Aupham, in 1861, in a paper read before the academy. He injected potassium iodide, into the respiratory system of two rabbits. One was killed immediately, and the lung substance tested by a solution of starch, for potassium iodide; but a very faint reaction was found, showing that the material was almost entirely absorbed. The second rabbit killed, after a lapse of ten minutes, did not afford the slightest trace of the salt. If bodies like potassium iodide, which are not at all volatile, can be absorbed so quickly, what must be the case with regard to gaseous substances, or with bodies of such tenacity that we are incapable of appreciating them by the senses; bodies such as are commonly classed as miasmata, emanations, etc.

While doubting that tuberculosis is transmissible, from husband to wife, we believe that it may be propagated from the sick one, to those who attend him. Whether or not there be a true miasmatic infection,

as some authors admit, it is certain that the fatigue, the watching, the confinement in the unwholesome air of the sick room, the chillings of the night, and, above all, the sad preoccupation, of which Laennec signaled the power in fostering the inbred tendency to phthisis, and which are unavoidable in similar conditions, are real and powerful causes of a weakening of nutrition.

We have studied the causes; to what conclusion does a consideration of the symptoms lead us? A pale complexion, yellowish, or straw color, discoloration of skin, a diminished embonpoint, and decrease in strength, a more or less rapid sinking, and a gradual alteration of all functions, somnolence, and finally a general collapse of the functions, forces and faculties. Causes and effects then correspond, both diminish the vitality by diminishing the physical powers of the organism.

In a diagnostic point of view nothing gives us a better account of the differences of which tuberculous modifications are susceptible, than the more or less intense and persistent effect, experienced by the nutritive functions. We may even go a step further and state that the alteration of the digestive and assimilative functions is the character proper, of the morbid modifications of the organism, from which depends the development of tubercles.

This is not a new theory, long before our time, physicians and physiologists had recognized the fact that any agent which tended to diminish the physical energies of the system, might become a cause of tubercle. But it is only to-day that these views have received a scientific demonstration.

The physician has but too often the opportunity of observing the insidious march of that terrible failing of the powers of nutrition under which the organism slowly and silently tuberculizes, until the moment when a congestion, or an intercurrent bronchitis, or other accidental cause, locates the trouble in the pulmonary parenchyma.

The weaker one is, the more irritable he becomes; that is to say, the more the organic aggregate is degraded, altered or morbidly modified, the more it is susceptible under the influence of the least modifying cause, of undergoing a more considerable degree of alteration, of lesion, and of manifesting a local or general trouble, more sensible and apparent, and capable of showing the idea of a powerful resistance, whilst it is only the effect of a near cessation of life by the organism. That is, *irritation and inflammation* are only effects common to all diseases, be they due to an excess or a lack of organic or vital conditions, and they indicate only an excitation, an augmenta-

tion, momentary and eventual, relative and local, and not absolute and general, of the organic movement.

What is the basis of the treatment for the prevention and cure of tubercle? In other words, what modification must be impressed, either directly or indirectly, upon the morbid state, in order that the parts involved may be restored to their normal condition?

As long as tubercle was thought to be specific in its origin, it was but natural that all efforts should tend to the discovery of a specific medicine, capable of neutralizing the supposed poison. But, to-day, better informed as regards the nature of the morbid affection, we no longer admit that it is specific in character, or that its evolution, development, and the different phases which it may assume, are anything like as uniform as was formerly supposed. Finally, we are led to believe, that as the influence of the sun and moon produces a rise and fall of the waters, so the modifications of the nutritive function exert an influence upon the manifestations of tubercle. It is from an observance of this very relation (though cause and effect are often confounded), that so much importance is placed upon the preservation of the general health, and the restoration of the appetite in a patient suffering from tuberculosis, and when we see the nutritive functions acting in a satisfactory manner, we have always grounds for hoping, while a failure of the strength and of the appetite, leads us to fear the worst.

Though the local character and site of the trouble should never be lost sight of, it is not from them that we are to derive our therapeutic indications, for it is only by influencing the general life of the sufferer, and by developing his physical powers that we can hope to alleviate if not to cure. In tuberculosis, there are not only similar and even identical indications founded upon the nature of the tuberculous lesions, but there are also indications which are different and even opposite which are dependent upon the cause and progress of the disease, its extent, and the seat of the lesions. II. Bennett has thoroughly established the multiplicity and diversity of the indications, and has shown that the disease is characterized by a diminution of the nutritive functions, and following this loss of strength and the development of an exudation, which in no way either as respects origin or local or general effects, differs from the simple inflammatory exudation. These considerations show us that in order to arrive at any satisfactory results, we have to fulfill at the same time two opposite indications:



1. To recuperate and fortify the general organism by suitable constitutional treatment.

2. To diminish the local, and subdue the general irritation, by an antiphlogistic and weakening treatment.

It is the necessity for the fulfillment of both these opposite conditions that has produced so much confusion in the minds of practitioners regarding the proper treatment, and given rise to almost interminable discussion as to the nature of phthisis, whether it is of inflammatory or non-inflammatory origin, and whether it should be treated by blood-letting, tartarized antimony and other depressing measures, or by tonics and a good stimulating regimen. No treatment of tuberculosis can be conducted upon a rational foundation, unless it combines, as intimately as possible, not only the similar, but also the opposite indications.

Any and all means that are able to arrest not only the inflammatory condition, but the modification which gave rise to it are good. If this modification be owing to an impoverished or vitiated state of the blood, result from what cause it may, and through it to a change impressed upon the organism, give to the blood and the organism the constituent in which it is deficient. If, on the contrary, the inflammatory action is due to an overabundance, or too great richness of that fluid, take such measures as will impoverish it. Thus though the means adopted are as opposed to each other as they can be, yet both tend to produce a single result, the return of the organism to its normal condition, and, as a sequel, the cessation of local trouble.

It is in a reparative and corroborant alimentation, chosen according to the particular state and condition of the subject, that, according to the opinion of all experienced physicians, we are to find the means of preventing and curing phthisical affections. As regards the aliment most suited to this class of patients, the general rules concerning the alimentary hygiene of valetudinarians, must govern us in regard to their selection. The regimen must be based essentially upon the use of analeptics, that is, the food under the smallest possible volume must be endowed with a considerable nutritive power, and contain as much fatty substances as the stomach will tolerate, and as the digestive functions, habitually, remain intact during a great part of the duration of the affection, we must prudently bear in mind the desires or idiosyncrasies of the patients in the determination of the aliments we allow them.

Independently of the general treatment, which is addressed to the disease itself and its cause, we must also be able to palliate the various

effects, which arise during the course of phthisis, and which, if not promptly checked, might seriously compromise the existence of the patient.

Whenever any one of the complications, which we will soon mention, arises, it is necessary that it should be immediately arrested, if possible, by some special modification, while the general alterative treatment is still continued. This plan is the more strongly indicated, when the disorganization of the lungs has advanced so far as to leave no other course open to the physician, excepting that of palliating particular developments of the disease.

The morbid phenomena which follow, as complications of phthisis, are: 1st. Cough; 2d. Dyspnœa; 3d. Hæmoptysis; 4th. Pains in the chest; 5th. Diarrhœa; and 6th, Colliquative sweats.

1st. *Cough*. This is one of the most important complications, which the physician is called upon to relieve. It generally appears at the very onset of the disease, and is paroxysmal in character, often being so severe as to determine vomiting, and almost to suffocate the sufferer. In some exceptional cases, it appears during the first stage, then ceases for a time, only to reappear in the latter part of the second. It is especially troublesome at night, and, by causing insomnia, greatly weakens the patient. It may be stated as a general rule that the intensity of the disease, and that of the cough, are directly proportional to each other.

The cough in phthisis is of two kinds, which differ entirely as regards their nature, and which we must distinguish carefully, on account of the different therapeutical indications which they present. One of them, sonorous, deep-toned, and moist, is formed by alternate long inspirations and expirations. It commonly occurs shortly after arising, when the bronchi, the benumbing effect of sleep having passed away, begin to regain their sensibility. This cough is beneficial to the patient, since it leads to the expulsion of that material which, if allowed to remain in the bronchi, might increase the dyspnœa. Sometimes it is even necessary to induce the expectoration. But when this becomes too profuse it may be necessary to diminish it, and the most satisfactory results will be obtained from the use of balsams and the sulphites. The second variety, the *tussis firma* of Graves, which may be called a spasmodic cough, is a useless expenditure of energy on the part of the sufferer. It weakens him, induces congestion of the lungs, deprives him of sleep, and brings on profound sweats. It is short, harsh, dry and convulsive in character. If the cough lasts for any considerable length of time, the expiratory muscles become

fatigued, and no longer permit the sufferer to cough, although it may still be necessary. Sometimes very painful points appear in various parts of the thorax and abdomen. Each paroxysm of coughing subjects the lungs to the action of two forces, one active the other almost passive. These organs are thus subjected to a greater or less degree of compression, and this, in turn, influences the circulation in the vessels of the pulmonary parenchyma. The blood, by this compression, is forced out of the capillaries and veins of the lungs, and finally into those of the neck, face, etc., thus causing redness, swelling, etc., of those parts.

According to Foussagrives, the causes of this cough are as follows : 1st. An abnormally dry condition of the mucous membrane ; 2d. A viscous condition of the mucous itself, which causes it to adhere firmly, and thus prevents it being removed by coughing ; an abnormally increased sensibility of the integument to the impression of cold ; 4th. An irritated condition or impressionability of the muscles of Reissenssen which is aggravated by the near proximity of tuberculous deposits.

The surest remedy for this cough is opium. However, it is very often contra-indicated. We must abstain from giving it when there is any tendency to pulmonary congestion. Opiates, also tend to diminish the appetite and to increase the night-sweats. The extracts of hyoscyamus, belladonna and phyllandrium, distilled cherry, laurel water, and cyanohydric acid, are all useful medicaments from which good results may be obtained, provided that we use them alternately and in increased doses.

2d. *Dyspnea*. This trouble ordinarily begins to manifest itself about the time the cough commences to annoy the patients, by a feeling of oppression in the middle portion of the chest, though the difficulty of respiration is generally more marked on one side than on the other. The treatment of this complication varies with its causes. These causes sometimes combined, sometimes aiding singly, may be enumerated :

1st. The infiltration of the lung by tubercular matter, and the diminution of the field in which hematosis takes place.

2d. The temporary or permanent congestion, which the presence of the morbid products in the lung develops.

3d. The plasmatic obliteration or induration of the peri-tubercular pulmonary vesicles.

4th. The emphysematous condition which is so prevalent in those suffering from phthisis, and especially in those who are troubled by



cough. The emphysema does not in this class of patients constitute a supplementary collateral respiration, as it has ingeniously but erroneously been called, but is a new cause of dyspnoea.

5th. A very abundant secretion, especially when the weakened expiratory forces are unable to carry on expiration.

6th. The disturbance of the equilibrium which should exist, between the amount of blood sent into the lung by the right heart, and the quantity of permeable tissue which it is to transverse. This form of dyspnoea which is accompanied by an accelerated pulse, and palpitation of the heart, consequent upon the least exertion, is due rather to cardiac than to pulmonary trouble, and is easy of recognition.

7th. Though the dyspnoea is due in the great majority of cases to the foregoing mechanical causes, yet in many instances it is owing to nervous derangement. (*Fonssagrives.*)

These are the cases in which medicine will be found to be of the greatest benefit. The chief indication is to promote expectoration. In order to accomplish this result we may resort to the infusion of polygala, the balsam of tolu, gum ammoniac, mineral kermes, scillitic oxymel, and especially ipecacuanha in nauseating doses. If the dyspnoea be dependent upon nervous trouble, belladonna is indicated. This complication may be momentarily relieved by sinapisms to the inferior extremities, burgundy pitch plasters between the shoulders, and the application of leeches to the malleoli.

Experience has shown that the maintenance of tissues, during the course of phthisis, or when the disease has begun to produce its marked constitutional effects, is not only dangerous, but tends to hasten the progress of the disease. What good result can we expect to obtain from the suppuration, caused by a seton, or the application of caustic? In order that we may have any revulsive effect, there must be a stimulus, so that there may be consecutive flow of blood to the part. But where is the stimulant to be found in a suppurative inflammation?

3. *Hemoptysis.* A knowledge of the relations sustained by the bronchi to the pulmonary and bronchial vessels gives an explanation of the manner in which hemoptysis takes place. The pulmonary arteries and veins accompany the smaller bronchi. That a communication exists between all three is shown by the fact that almost all injections, although only a moderate degree of force is employed, may, with the greatest ease, be made to pass from the arteries into the pulmonary veins and bronchi, the inflamed parts alone seeming impermeable. Injections into the bronchi, or into the pulmonary veins,

although the latter do not contain valves, cannot be forced into the arteries, neither can they be forced from the bronchi into the veins. That the bronchial arteries and veins communicate with the pulmonary vessels is proved beyond-question by the experiments of Haller, Soemmering, Reissenssen, and Boyer. These facts being premised, together with the knowledge that around deposits of tubercle new vessels are always found, it follows that, since the sanguineous congestion around such a diseased mass must be very intense, the capillaries will become distended beyond their power of resistance, and the blood will find a passage into the bronchi, and thus constitute hemoptysis. When it is not so profuse as to threaten immediate danger, or such as weakens the patient very much, it is to be regarded as beneficial, since it unloads the congested vessels, and in this way prevents, for a time, further inflammatory action, by removing the congested state by which it has been occasioned. There is also a possibility that it prevents, for a time, the further deposit of tubercle. Who has not noticed, in patients suffering from phthisis, the great relief which followed a slight attack of hemoptysis? Hence we must refrain from interfering, as long as the hemoptysis preserves the character of an active hemorrhage, and the pulse, heat of body, color of face, and the amount of dyspnea indicate that the hemorrhagic molimen is not completely checked. If all signs of congestion cease with the termination of the hemorrhage, there will only remain to the physician to take measures to guard against the return of such congestion; while if, although the hemoptysis has ceased, active inflammatory action still continues, then revulsive treatment, applied to parts distant as possible from the seat of the inflammation, such as blisters upon the lower extremities, leeches to the malleoli, etc., will be indicated. It is only when the hemorrhage has assumed such proportions that the life of the patient is endangered, that the physician should take prompt measures for its suppression.

Hemoptysis may be dependent upon another cause, viz., extensive destruction of pulmonary tissue and ulceration of vessels, which have not been obliterated. This variety may be considered to be traumatic in its origin, and as subserving no good purpose. If possible, it should be stopped at its very onset. Absolute rest, acidulated drinks, rhatany, ergot, tannin, ferric chloride, etc., are the agents upon which reliance is to be placed; and the dose given should be proportioned to the intensity of the hemoptysis.

How are we to distinguish between these two varieties of hemoptysis? In the first variety there exists an inflammatory molimen, of

which the patient, anxious as regards the condition of his lungs, has perfect cognizance. It also betrays its presence by exterior signs. In the second variety this inflammatory condition is absent, and the trouble manifests itself suddenly and violently.

4th. *Pains in the chest.* Laennec's view, that pleurisy instead of being a cause of tubercle, was far more often the result of this affection, always seemed to me to be the true one. Tuberculosis itself, produces no pain; the pain in the chest experienced by sufferers from phthisis, whether it be in the neighborhood of the scapulae and clavicles, or at other points of the chest is, without doubt, due to partial pleuritis, or to intercostal neuralgia. If the pain be due to a pleuritic attack, the application of a few leeches, or the abstraction by cupping, of two or three ounces of blood, will, by unloading the congested vessels, give relief far sooner than any other remedy. I have also, often, in my own practice, followed with the happiest results that of Tanner, who advises, that even before this small quantity of blood is abstracted, the effect of fomentations, and extract of belladonna, should be tried. If the pain is neuralgic in its origin, I have seldom failed to give relief by applying a blister containing morphine.

5th. *Diarrhœa.* It is of the utmost importance that this complication of phthisis should be cured, or at least alleviated, on account of its fearfully weakening effect upon the sufferer. Often, in the beginning of phthisis, it is due to a hyperæmic condition of the intestines which is susceptible of cure, but later on, when it is owing to ulceration of the mucous membrane, caused by a deposit of tuberculous matter therein, it is not so amenable to treatment; this, however, should be persevered with, and if a cure cannot be effected, yet the condition of the sufferer can be greatly improved. Of the medicines used in this complication, the English seem to place great reliance upon the aqua calcis given in milk. Tannin combined with some inert substance will often be found to give relief. In my hands rhatany administered in the form of a tea, has seldom failed to yield good results. According to Bichat, the subnitrate of bismuth lessens the amount of local irritation which the fluid contents of the intestine exert upon its sensitive membrane, and thus diminishes the tendency to peristaltic action. Opiates should only be given in the form of rectal suppositories, and even then, in small doses, so that no sudorific effect will be produced, as they generally diminish the appetite. However, benefit is often obtained from injections of vinum, or tinctura opii, as they not only stop the diarrhœa but often increase the strength.

6th. *Colligative Sweats.* The so-called sweat of phthisis begins



as a gentle perspiration in the earlier stages of the disease, and only becomes strongly marked, at an advanced period. It is an almost constant symptom. It happens very often that the diarrhoea and night sweats, supplement each other *i. e.*, one attacks the patient for a time, and then subsiding, gives way to the other. Both, however, whether they alternate or exist simultaneously, produce very disastrous effects, destroying as they do, the strength of the patient, and producing the last degree of marasmus. It is during the morning hours, just before the awakening, that the patient is most troubled by these sweats, so that when he awakes, he finds himself almost invariably bathed in a profuse perspiration. It begins at the head and, gradually extending downwards, finally embraces the whole body. It is rare to find them restricted to a single part. Against this almost inseparable accompaniment of the last stage of phthisis, an almost endless number of medicines have been proposed. Among those whose efficacy has been proved, is tannin and the tannate of quinine, zinc, oxyd, and Dover's powder. From the last I have obtained excellent results.

#### ON THE CURABILITY OF PHTHISIS BY ARSENICAL MEDICATION.

The maintenance of the nutritive function at the normal standard is to be regarded as the sheet-anchor of salvation. No matter how strong the tendency may be to the development of this disease, if nutrition remains normal the trouble is suppressed or happily modified. When the disease has already but too clearly given evidence of its presence, if we can in any way reanimate the nutritive function, so that the vegetative life can be sustained, then we may not only prevent any further manifestation of its terrible consequences, but the existing trouble may be eliminated.

The pharmacopœia contains a sufficient number of remedial agents; some say too many. However this may be, we believe that the secret of its successful use will depend less upon new acquisitions than in a wise and judicious utilization of its present resources. The remedy that I am about to advocate is not a new one; neither is it a specific, possessing the privilege of being successful where all others fail; but it is an agent by means of which such good results have been obtained that it should not be cast aside, especially as its employment is attended with but very little risk to the patient, as will be demonstrated a little later on.

Latour has said, that "one is phthisical before he has tubercles." This idea is not only true, but far-reaching. Let us bear in mind the morbid disposition which tends to produce them, and the abnormal

condition of the digestive function which causes them to be deposited, and allows them to develop. Let us fear their possible development as soon as severe and prolonged disturbances of the nutritive function manifest themselves.

Hence the great object for which the physician should perseveringly and untiringly strive is, to increase the appetite and strengthen the power of assimilation. Arsenic does both.

Arsenic, on account of its toxicological relations, has, undeservedly, attained a rather equivocal reputation. Many patients are very apprehensive of serious consequences following the continued use of a poisonous agent, or even from taking a very small quantity of it. Since the human mind is guided, not only by words, but also by impressions, it is evident that the latter will, for a long time, exert an unfavorable influence against the use of this agent, though it is far less dangerous than many of the vegetable alkaloids which are so commonly used.

Cyanohydric acid, for example, is so exceedingly poisonous that a single drop of the chemically pure acid is sufficient to destroy life, and yet its use is countenanced, nay, insisted upon, by such high authorities as Drs. Nelligan, Granville, Chambers, Druitt, A. F. Thompson, Donovan, Trousseau, etc., in cases of gastric irritation, nervous palpitation, spasmodic asthma, convulsive dyspnoea, neuralgia, etc.

A more thorough investigation, and a more extended use of arsenical preparations, have demonstrated that this substance, which, in large doses, destroys life so rapidly, in smaller ones not only restores the appetite and stimulates the nutritive function, but, as it were, calls into being all the powers of the vegetative life. It is on account of this property that its use is followed by such favorable results in those affections which are characterized by marked asthenia, and great disturbance of the nutritive functions.

A careful study of the effects of this mineral, in physiological conditions of the system, upon those accustomed to its use, has shown that it renders the system less liable to disease, that it regulates the circulation, and, still further, it develops and maintains the muscular and nervous energy of the organs of the vegetative life. Thus the nutritive function is maintained in its normal vigor, and the patient, being strengthened and invigorated bodily, has this salutary influence of his physical well-being reflected upon his mind. If arsenic can, in small quantities, produce such good results in the physiological state, need we fear harm from it in a pathological one? Besides, as its effects are consecutive, and not immediate, we can obviate any chance of its

producing evil consequences. We can also, by a proper attention to the quantity given, so graduate the effect that any organism, no matter how susceptible it may be, can tolerate it, and hence be benefited by its use. Our own experience of it is such that we may, with Isnard, say, that, notwithstanding the evil reputation which it has obtained, arsenic is one of the most useful and harmless of medicines. It seems to agree even better with children than with adults. Both, however, soon begin to tolerate its use, and the effect, once obtained, continues two, three or more months, or even indefinitely.

Isnard goes still further, and asks, if, in cases where all the concurrent symptoms pointed to an early development of phthisis, the persistent use of arsenic prevented the appearance of any pulmonary lesions, or where, in other cases, it stayed their progress, we are not justified in concluding that, in a great number of patients, it will not only prevent any further development of the disease, but actually cure that already existing.

This agent, according to the same authority, does not act by changing the constitutional tendency of the patient, or by destroying the tuberculous deposit itself; but it exalts the nutritive function, and increases the vital energy, thus placing the economy in a condition the very opposite of that which gave birth to and aggravated the tubercular state.

Need we recall the testimony of Fowler, Robert Milan, and Robert Pearson; the experiments of Boudin, physician-in-chief to the military hospital du Roule, Paris; the cure of epilepsy by Harles, and of chorea by Bayer; the success obtained by Martin Gregory in England, Babington, Hughes, Alexander, in the treatment of angina pectoris; in the treatment of asthma by Koepf; of chlorosis and bronchorrhœa by Trousseau?

Dioscorides gave arsenic to patients who had collections of pus within the thoracic cavity. Swogt, professor at Jena (1700), and after him, Melchoir Frick of Ulm, used it in intermittent fever. Dr. S. D. Gross gave one-half of a grain of arsenious acid a day in neuralgia of the bladder. Drs. Hooper and Frampton prescribe the liq. potass. arsen. in epilepsy. Dr. Drnitt and Dr. F. W. Mackenzie use it in hay-fever. Dr. J. Hogg, of London, uses it in diabetes. Bouchut has shown that arsenic is extremely useful in the various forms of scrofula. Loude, Frahn, Isnard, Bouchut, Gourbeyer, etc., have used arsenic in pulmonary tuberculosis with relative success. Beddoes, according to Girdlestone, treated successfully a patient suffering from phthisis whose two brothers had died of consumption.



Let us quote Trousseau: "Our experiments have been made upon sufferers from phthisis, and patients afflicted with chronic catarrh of the larynx. In the former we have not effected cures, but we have obtained at least very extraordinary suspension of accidents, in a disease in which nothing is able to retard the fatal onward march. We have seen the diarrhœa moderate, the hectic fever diminish, the cough become less frequent, and the expectoration assume a better character; but we have not cured. However, the results that we have obtained are an encouragement for us to proceed; and nothing militates against the belief that, if the affection be limited, we may obtain a complete cure."

"We wish all to believe that in our experiments with arsenic, no error of diagnosis has been committed. We are granted, at least we hope so, enough hospital experience, and practice in auscultation to believe that in a confirmed phthisis, and that in the second stage, we have not mistaken the pulmonary lesions, and made an error from considering alone the general symptoms, which preceded or accompanied the affection; besides our examinations were made in the presence of a large number of pupils who followed our clinic, and who, most of them, had already received the degree of M. D., or were in the last year of their studies."

Isnard reports three cases advocating the use of arsenic, which are of real interest to us. The first is that of a patient aged forty-five, who was suffering from hereditary (?) phthisis. He had softened tubercles in both lungs, hectic fever, night sweats, etc. During three months arsenious acid was given; at the end of that time the progress of the phthisis was checked, and two years afterward, no traces of the disease could be found. The second case possesses even greater interest. It is that of a young woman, whose mother had died of consumption, and who herself had manifested unequivocal symptoms of that disease after her first confinement, and an ineffectual attempt to nurse her child, conditions which we know do not stop the progress of tuberculosis. A year later under arsenical treatment, she had regained, to all appearance, her health. If that period is too short to admit of an absolute cure, the result obtained by the use of arsenic is none the less striking. The third case related by Isnard, is that of a young man of twenty-one, suffering from unilateral caverns, and in whom these lesions complicated with intercurrent pleuro-pneumonia and pleuritic effusion, had produced a veritable marasmus. Here the cure was less complete, but the fact of the ability of arsenic to stop the progress of phthisis, or, at least to retard its onward march is none the less evident.

At present it is difficult to say what the future of this medicament will be, but its constancy, effectiveness, and power of producing the required result commend it to the serious attention of practitioners.

In our hands its results have been most satisfactory, and without discarding the various medicines ordinarily employed to rebuild the tuberculous organism, we have arrived at the conclusion that arsenic should be placed in the front rank. We have given it simultaneously or alternating with cod liver oil, preparations of cinchona, ferrum iodide, and the alkaline hypophosphites.

In a great majority of the cases in which favorable results were obtained, the patients were subjected to a treatment which was more or less complex in its character, so that it would be impossible to tell what medicine had produced the desired result. In four cases, however, arsenic alone was employed, and then only when all other treatment had failed, and in these cases very satisfactory results were obtained.

*Case 1.*—Mrs. D. of Toronto, visited me in the early part of February for aphonia. She, at the same time, related to me the condition of her sister as follows: Emma is now nineteen years old, she menstruated at thirteen. For the last seven months she has been in bad health, and during that time her appetite gradually diminished. She began to grow thin and her menses stopped entirely. Soon there was oppressive pain in the chest, cough, and from time to time shivering. Father died two years ago (his death was accidental); mother is strong and healthy.

On being asked to give an opinion and advice, I requested her to write home and have the family physician examine her sister. A week later she communicated the following:

“On the right side the chest is perfectly sonorous, the respiratory murmur normal, perhaps a little exaggerated. On the left side superiorly in front of the supra-clavicular fossa, as in the infra-clavicular fossa, behind in the supra-scapular and in the whole infra-scapular space, percussion denotes a diminished sonority. Auscultation is more positive. Almost complete absence of respiratory murmur replaced by a well defined crepitating sound; no pectoriloquy.”

In the absence of more definite information, and with the reliance which I had already in the power of arsenical preparations, I directed her to take arsenious acid in pills ( $\frac{1}{50}$  grain), beginning with two a day and gradually increasing the dose, until she took daily one-sixth of a grain of the medicine. This was in February. A little more than a week later Mrs. D. returned home, and wrote me that she thought

Emma worse from taking the medicine; that she had taken to her bed and was falling off fast; that she had diarrhoea, a good deal of night sweats and no appetite at all, and begging me to send her some other medicine. This was not very cheerful information. However, I directed her to keep on using the pills as ordered. March 20th, another communication stating that Emma was less weak and had been able to go around the room twice during the last few days, and that she began to have an appetite for food. April 15th, Emma has walked out for the first time in three months. The cough has diminished considerably; the red spots on the cheeks have disappeared little by little as she gained strength.

When last heard from (July 29th), Miss Emma R. had gone with her mother to St. Catharines, feeling perfectly well, and eating enormously.

*Case 2.*—Mary B. was twelve years old when I first saw her. Near old cicatrices on the neck, she had two enlarged glands, of which one was ulcerated and the other on the point of being so. The first engorgements had shown themselves at the age of four years, and lasted till she was seven. They then, after an interval of five years of apparently good health, returned. Instead of the preparations of gold which the child was then using, I subjected her to arsenical treatment, beginning with one-fiftieth of a grain. The enlarged gland suppurated, but healed very rapidly. To-day, twenty-two months after the cure, no new enlargement has appeared to deny the good effect of arsenic. In this case the use of the arsenic was continued for more than six months, without any apparent trouble arising from its use.

*Case 3.*—In August last I was called to see Mr. R. Fitful, like all sick men, he had just discharged his last medical attendant, the third within a year. His face was pale, and showed traces of great suffering; respiration harsh, twenty-four to twenty-six per minute; pulse, 120 to 124; cough hollow and deep; expectoration abundant and purulent in character; hectic fever. Although he spat no blood, the sight of that great emaciation, the sweat which scarcely ceased even in the day, led me to prognosticate a fatal termination.

Though I feared but little could be done, still I thought, why not try arsenic? The patient strongly objecting to any kind of pills, which he said would choke him, I prescribed an aqueous solution of arsenious acid, each fifty grammes of which contained one centigramme of the acid. Within three days the intensity of the fever had abated considerably. Notwithstanding the high pulse, the skin, from being



dry and burning, soon became fresh and natural, and the night sweats steadily diminished. At the end of the first week the palpitations of the heart, which had alarmed the patient so much, under the sedative influence of the arsenious acid, had almost entirely ceased. From day to day the change for the better steadily manifested itself; the appetite returned; the expectoration became less abundant and less purulent in character. There is still a little cough; but the patient is gaining strength rapidly.

*Case 4.*—Lottie C., a seamstress by occupation, states that her cough began last winter, but it is only during the last three months that she has been obliged to give up work. She experiences a sensation of weight on the left side of the chest; expectoration sometimes streaked with blood, and generally thick and viscous; she has night sweats, and her emaciation is very marked. Auscultation reveals a relative diminution of the respiratory murmur, with sibilation and friction sounds in the left lung. At the apex of this lung, both anteriorly and posteriorly, the percussion sound is dull; voice resonant.

At the beginning of the treatment, she complained for two days of colic and slight diarrhœa. However, the treatment being continued, the cough, at the end of the second week, had diminished considerably. Two months afterwards her appetite was excellent, her strength greatly increased, the color of the face natural, and she resumed her work.

This power of arsenic to rebuild functions which have been almost entirely lost, is very remarkable. That it is able to do this, we have shown by the preceding cases, and, moreover, have supported our statement by the testimony of high authorities. To me it seems that, in increasing the nutritive function and restoring the appetite, it fulfils one of the most important indications, viz., to retard the decline of nutrition, and thereby prevent physical loss.

Even if we admit that the results obtained by the use of arsenious acid are but momentary, yet we must acknowledge that this medicine is able, in the last stages of tuberculosis, to do what no other one can, strengthen the power of the nutritive function, and remove, for a time, at least, all danger arising from colliquative accidents.







